

Observations

- Most of α -particles passed without any deflection
- few α -particles deflected with small angles & very few α -particles (1 out of 2000) deflected with angle $> 90^\circ$

Remarks/Conclusions

- Atom is mostly empty inside
- Deflection is due to repulsion b/w α -particle & nucleus which suggest that total positive charge is confined in a very small region called nucleus.

Key points in Rutherford's Atomic model \rightarrow

- All protons in atom is present in nucleus.

All neutrons also present in nucleus.

Protons & neutrons collectively called **NUCLEONS**.

$$\text{no. of neutrons + protons} = \text{Mass No. of atom (A)}$$

- Total mass of atom is concentrated in its nucleus

$$\begin{aligned} \text{Mass of atom} &\approx m_p \times n_p + m_n \times n_n \\ &\approx (n_p + n_n) \text{ amu} \\ &\approx (\text{Mass No.}) \text{ amu} \end{aligned}$$

$$m_p \approx m_n \approx 1 \text{ amu}$$

eg: ${}^{14}_7\text{N} \Rightarrow \text{Mass of N-atom} = 14 \text{ amu}$

- Diameter of atom = $10^5 \times$ Diameter of Nucleus

- Radius of Nucleus of any atom = $R_0 \times (A)^{1/3}$

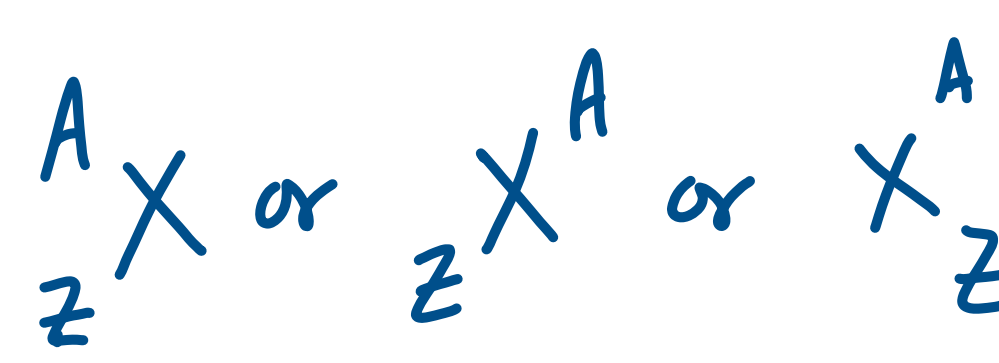
$$R_0 = \text{Radius of nucleus of H-atom}$$

eg: Radius of nucleus of ${}^{16}_8\text{O} = 1.3 \times 10^{-15} \times (16)^{1/3} \text{ m}$ \rightarrow femto meter

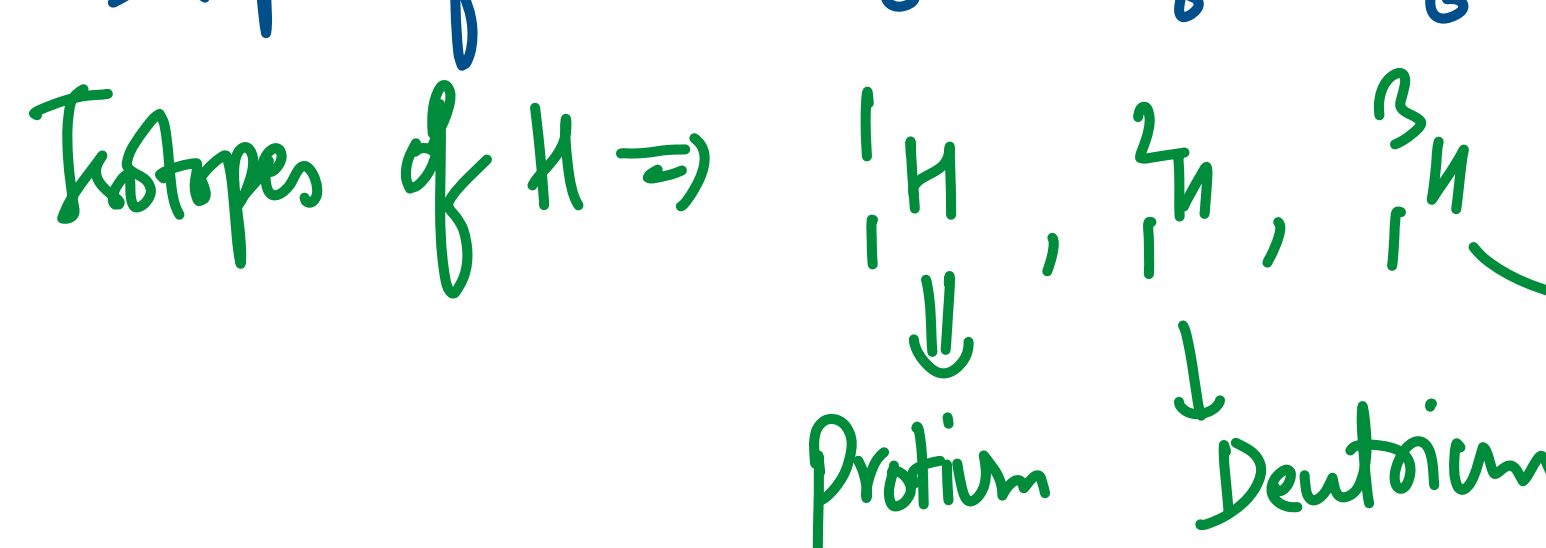
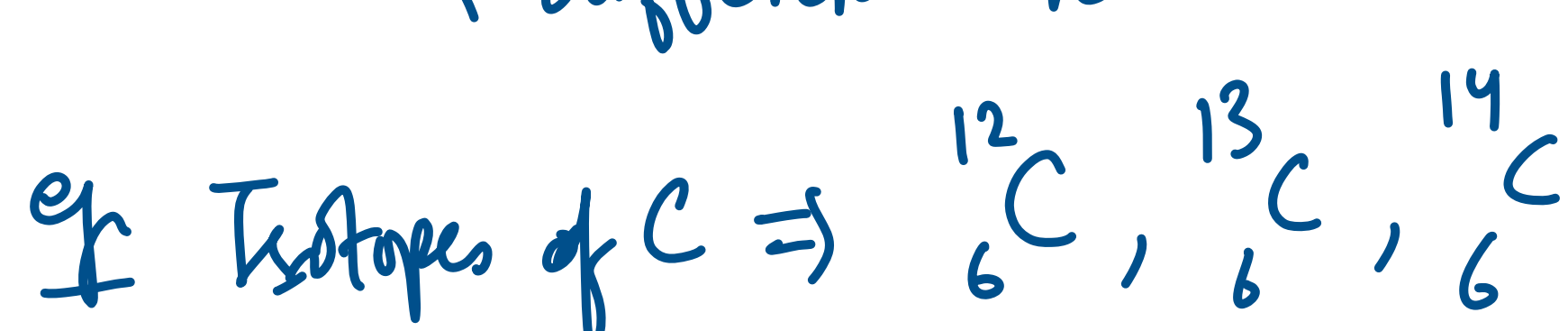
- e^- revolve around the nucleus like planets revolve around sun.

Some important terms

\Rightarrow no. of protons decide symbol of element



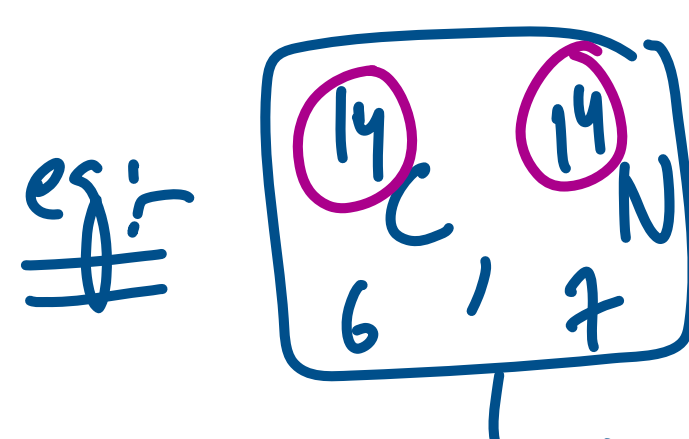
- Isotopes** \Rightarrow Atoms of same element have same Z & different A & different n_n



Tritium \rightarrow Radioactive elements

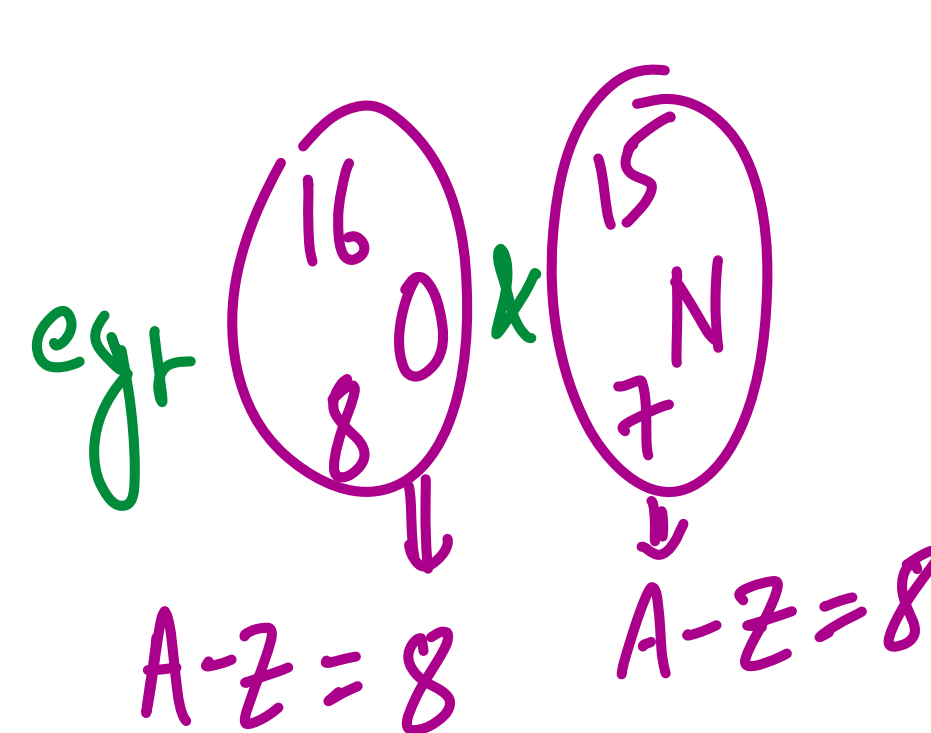
- Isobars** \Rightarrow Atoms of different elements having

- \rightarrow same A
- \rightarrow different Z
- \rightarrow different no. of neutrons



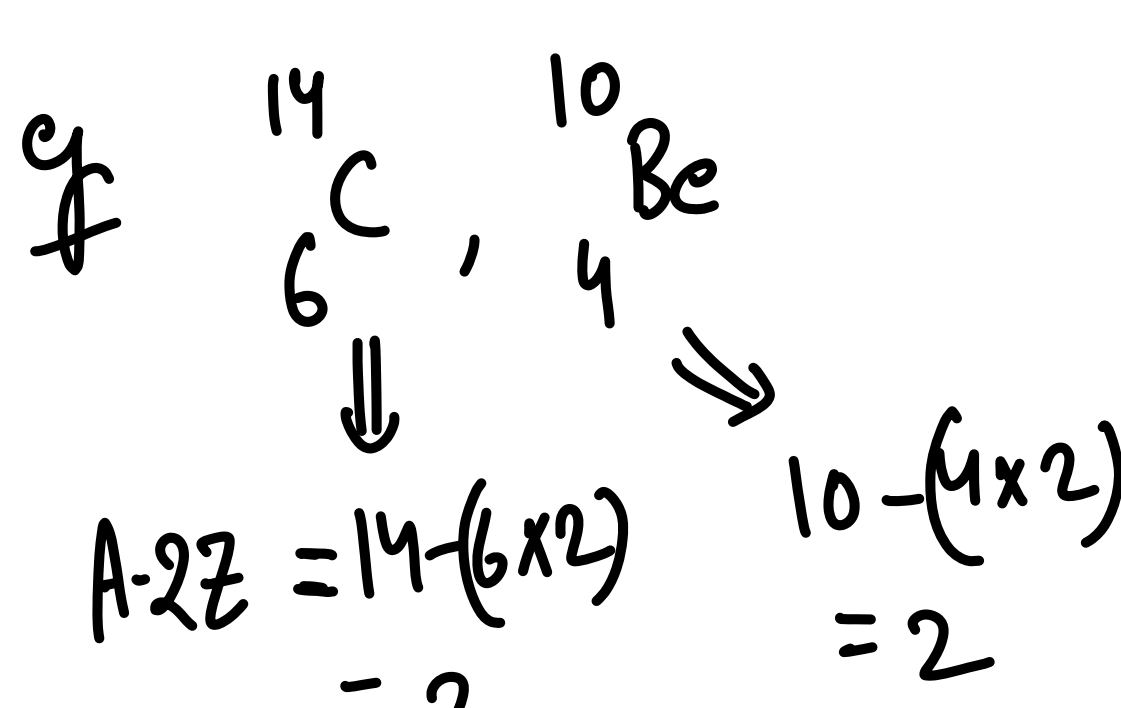
\rightarrow Isobars

- Isotones** \Rightarrow Atoms of different elements having same no. of neutrons (A-Z).

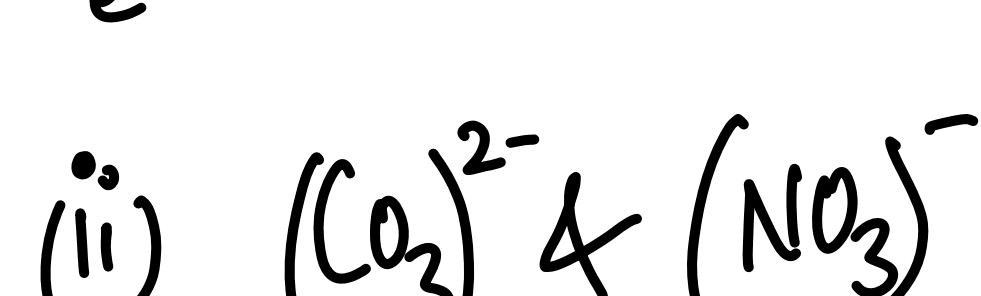
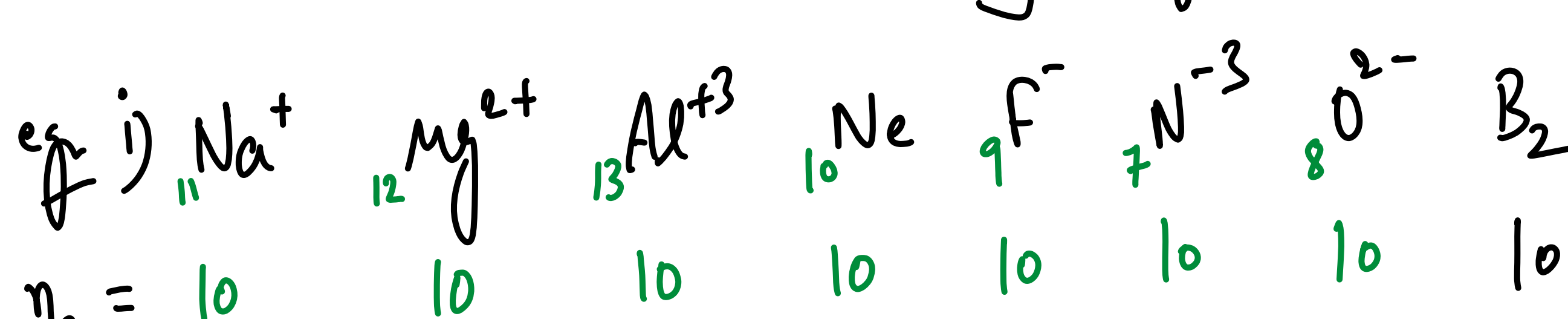


- Isodiaphers** \rightarrow Atoms having same Isotopic No.

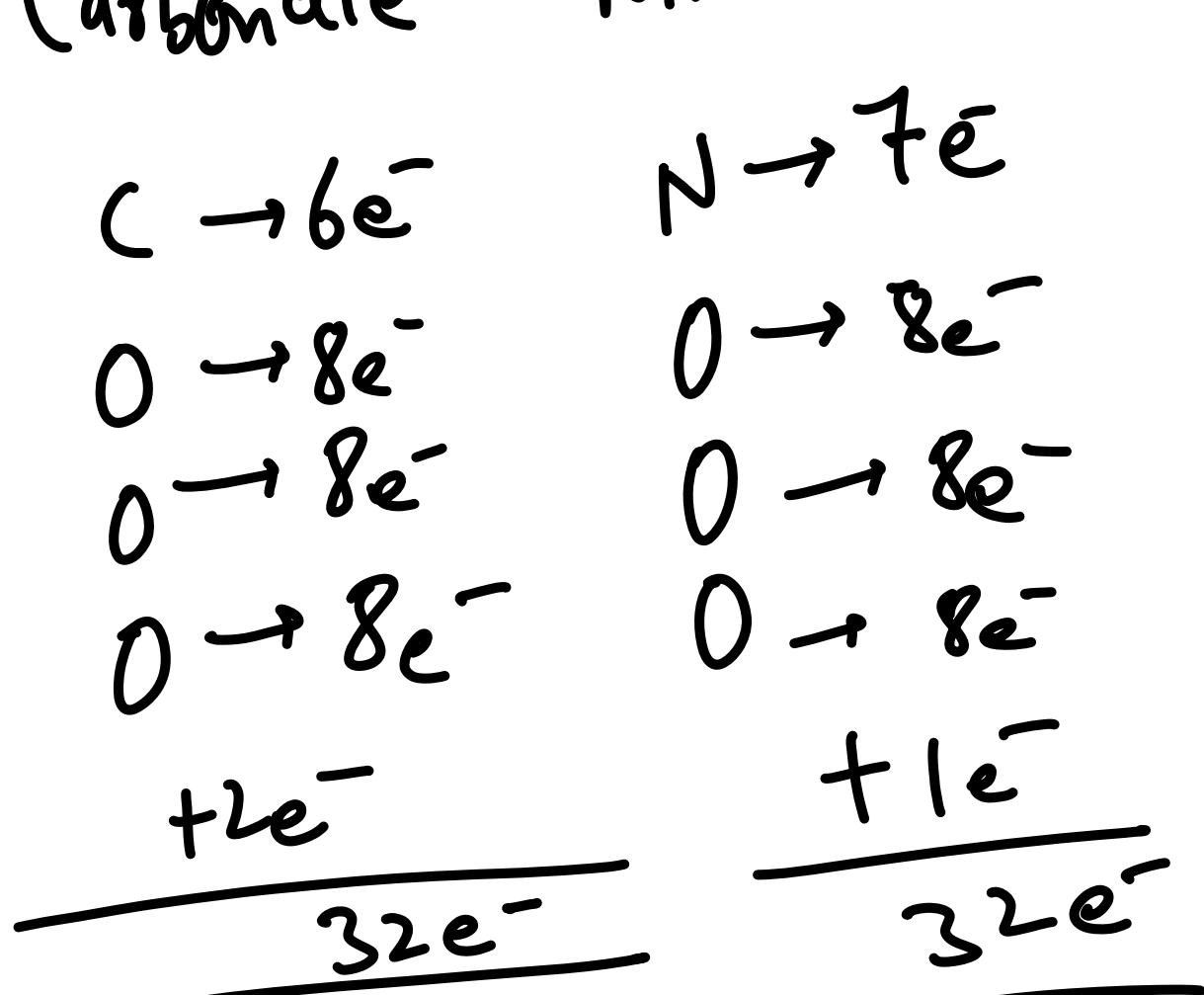
$$\begin{aligned} n_n - n_p &\propto A - 2Z \\ A - Z - Z &= A - 2Z \end{aligned}$$



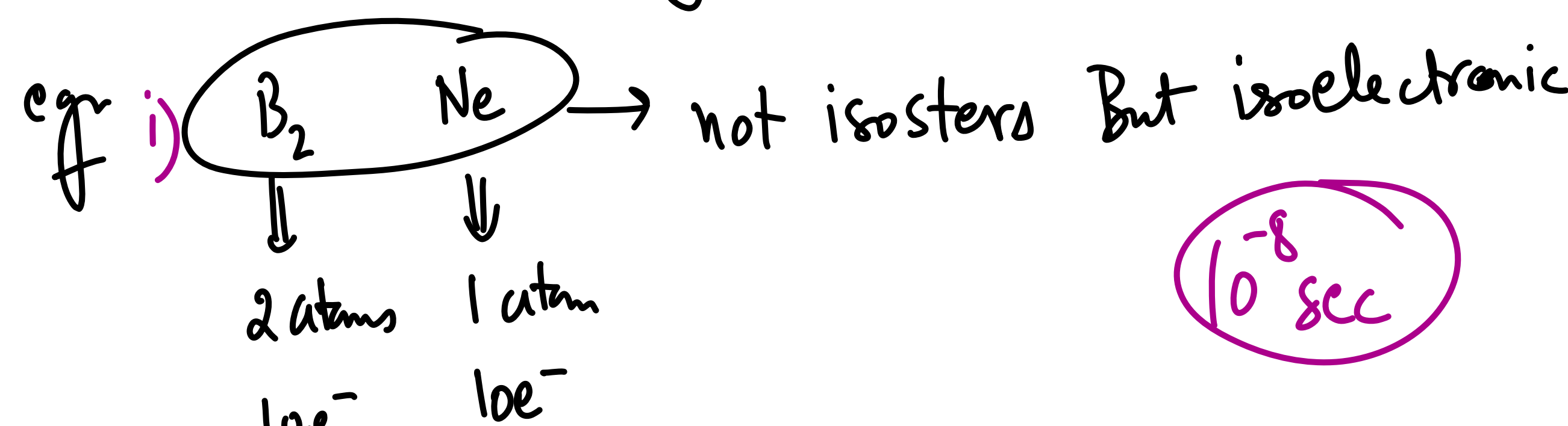
- Isoelectronic Species** :- Species having no. of electrons.



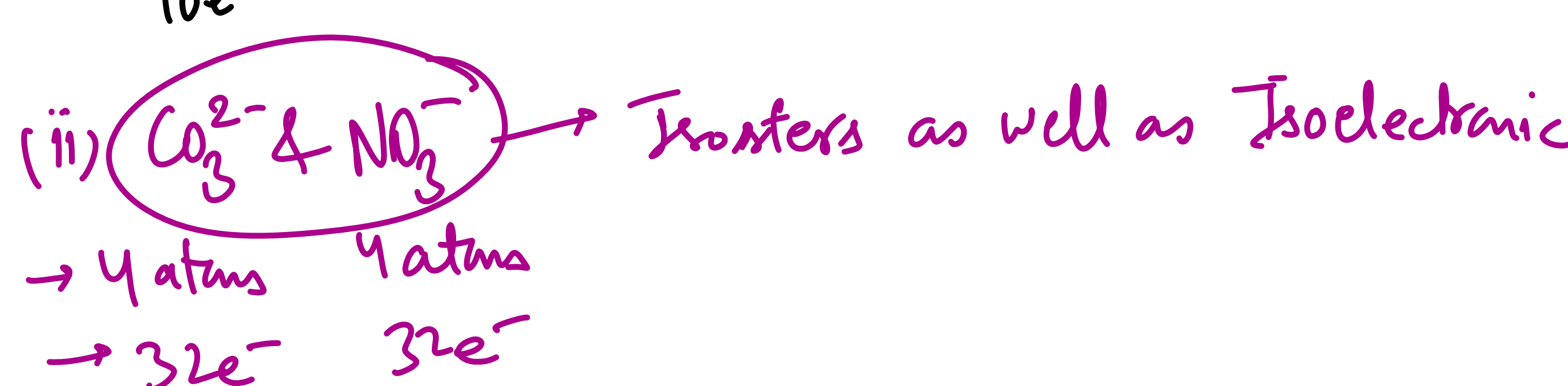
Carbonate Nitrate



- Isosters** :- Species having same no. of atoms as well as electrons.



$$10^{-8} \text{ sec}$$



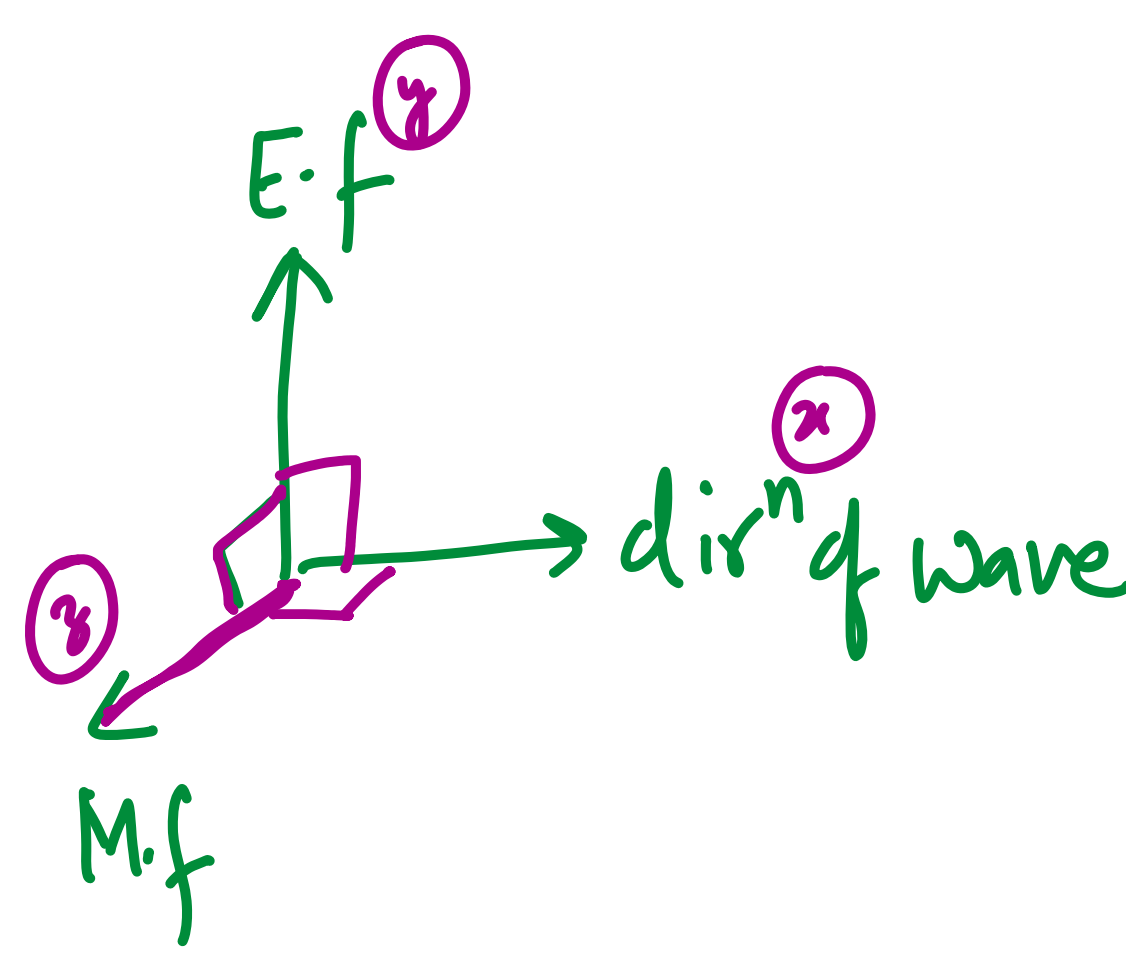
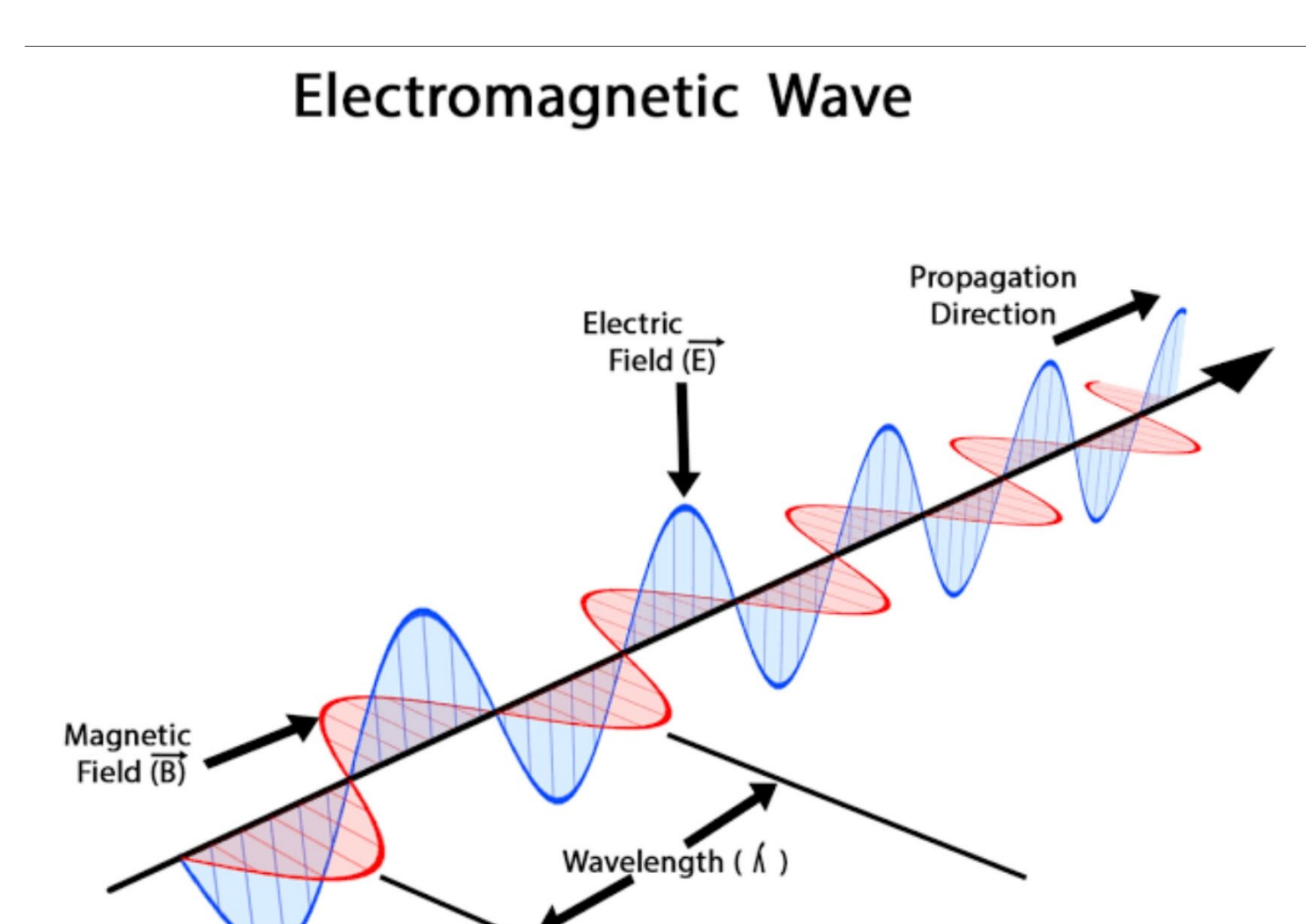
Failure of Rutherford's Model

- He could not explain stability of atom. \Rightarrow According to Maxwell, e^- being charged particle must lose energy during its motion around the nucleus & must fall into nucleus in less than 10^{-8} sec .
- He did not provide arrangement of e^- s around the nucleus

Electromagnetic Radiations (EM radiation)

Charged particle under acceleration loses energy which travels in form of waves called **EM waves**.

These radiations contain 2 oscillating field components called Electric field Component & Magnetic field component

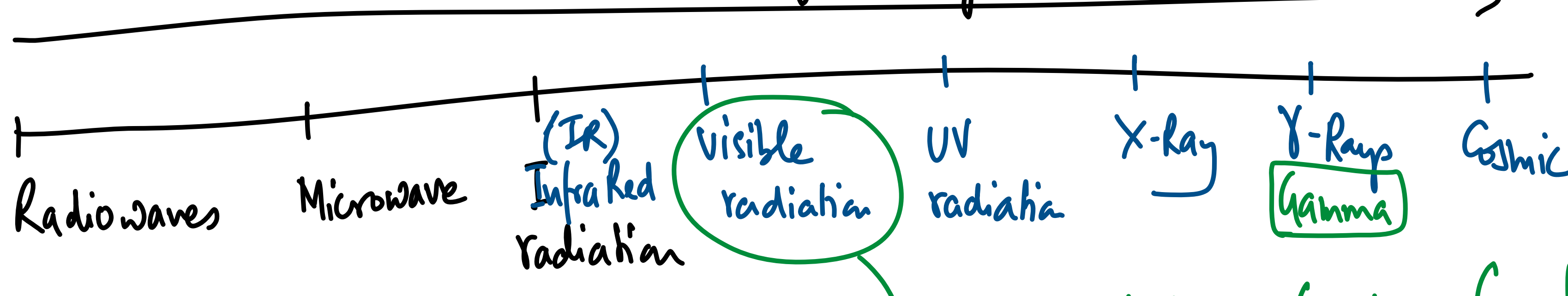


\Rightarrow EM radiations travel with speed of light in vacuum.
 $c = 3 \times 10^8 \text{ m/s}$

\Rightarrow EM radiations are self sustaining in nature (they require no medium)

\Rightarrow All EM radiations are arranged in increasing or decreasing order of wavelengths or frequencies called **EM Spectrum**.

λ dec, frequency \uparrow



Raj Malhotra Is Visiting Uncle Xaviers Garden Constantly

Visible spectrum \rightarrow Visible to human eye & colored
 Violet $\Rightarrow \approx 350 \text{ nm}$
 Indigo
 Blue
 Green
 Yellow
 Orange
 Red $\Rightarrow \approx 750 \text{ nm}$

Properties of Waves